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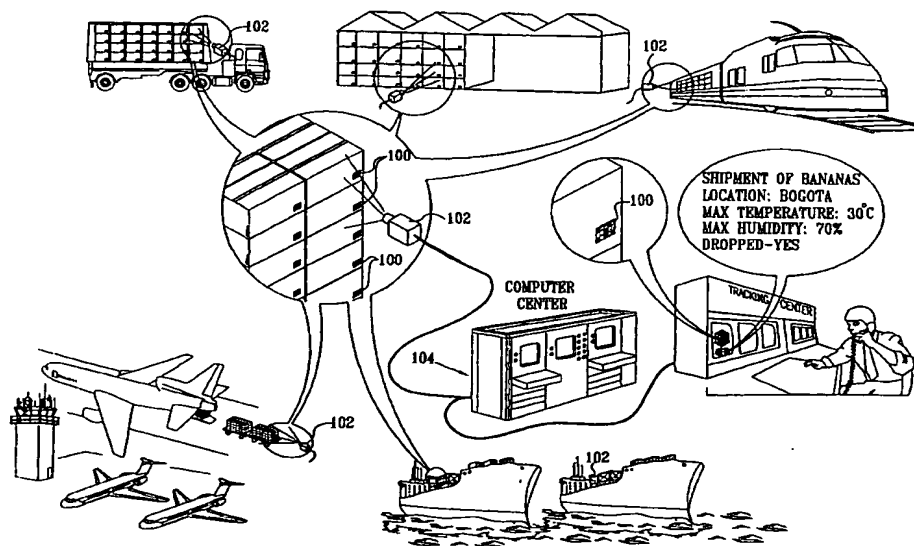
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(54) Title: **SYSTEM AND METHODOLOGY FOR TRACKING OBJECTS USING VISUALLY SENSIBLE INDICATORS**



(57) Abstract: A system for tracking objects (10, 30, 502) including visually sensible indicators (12, 32, 74, 100, 238, 300, 400, 504, 600) on objects being tracked, at least one imager (14, 34, 102, 200, 210, 220, 222, 230, 234, 500) capturing images of the objects being tracked which images also show the visually sensible indicators and at least one image processor (16, 36, 104, 202, 212, 224, 236, 506) receiving outputs of the at least one imager and extracting from the outputs coded information indicated by the visually sensible indicators, the coded information being viewable on a display (18, 38), either locally or at a remote location (20, 40, 204, 214, 226, 240).

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AMENDED CLAIMS

**[Received by the International Bureau on 05 January 2004 (05.01.04)
original claims 1-86 replaced with claims 1-119]**

1. A methodology for tracking objects comprising:

imaging together at a known location a plurality of objects to be tracked, each object having at least one imagable identifier affixed thereto to provide an at least partial image of said plurality of said objects, said at least partial image including at least each of said at least one imagable identifiers;

employing said at least partial image to determine an identification code for each of said plurality of objects; and

associating each identification code with a known location code.

2. The methodology as in claim 1 further comprising communicating said at least partial image and its associated identification and location codes to a remote location.

3. The methodology as in claim 1 further comprising communicating said identification code and its associated location code to a remote location.

4. The methodology as in claim 1 and also comprising storing said at least partial image and its associated identification and location codes.

5. The methodology as in claim 1 further comprising storing said identification code and its associated location code.

6. The methodology as in claim 1 wherein said imaging is color imaging.

7. The methodology as in claim 1 wherein said at least one imagable identifier comprises a multi-color identifier.

8. The methodology as in claim 1 wherein said at least one imagable identifier comprises a multi-segment, multi-color identifier.

9. The methodology as in claim 8 wherein said identifier is capable of identifying and distinguishing a plurality of objects at least equal to approximately:

$$\text{Plurality of objects} = (n \times (n - 1)^{(p-2)} \times (n - 2))/p$$

where n is the number of different colors and p is the number of segments.

10. The methodology as in claim 9 wherein said identifier has an inherent orientation.

11. The methodology as in claim 1 wherein said steps of imaging, employing and associated are repeated for different pluralities of objects passing a given imaging location.
12. The methodology as in claim 1 wherein said at least one imagable identifier comprises a plurality of imagable identifiers arranged in at least predetermined propinquity to each other.
13. The methodology as in claim 1 wherein said employing comprises extracting said identification code from said at least partial image.
14. The methodology as in claim 1 wherein said identifier has an inherent orientation.
15. The method as in any of claims 1 - 14 and also comprising displaying said at least partial image in conjunction with its associated said identification and location codes.
16. The method as in any of claims 1 - 15 and wherein said at least one imageable identifier comprises a dynamic indicator.
17. The method as in any of claims 1 - 16 and wherein said at least one imageable identifier provides non-alphanumeric indications of multiple parameters relating to an object onto which the identifier is mounted.
18. The method as in any of claims 1 - 17 and wherein said at least one imageable identifier provides a coded indication of at least two of the following parameters: object location, object identity, object maximum temperature history; object maximum humidity history; object minimum temperature history; object minimum humidity history; object tilt history, object G-force history.
19. A method as in any of claims 1 - 18 and wherein said at least one imageable identifier changes its visual display in real time in accordance with the parameters indicated thereby.
20. An object tracking system comprising:
an imager to image together at a known location a plurality of objects to be tracked and to provide an at least partial image of said plurality of said objects, said image including at least each of said at least one imagable identifiers;

a processor employing said at least partial image to determine an identification code for each of said plurality of objects and to associate each identification code with a known location code.

21. The system as in claim 20 further comprising a communication unit to communicate said at least partial image and its associated identification and location codes to a remote location.
22. The system as in claim 20 further comprising a communication unit to communicate said identification code and its associated location code to a remote location.
23. The system as in claim 20 wherein said at least one imagable identifier comprises a multi-color identifier.
24. The system as in claim 20 wherein said at least one imagable identifier comprises a multi-segment, multi-color identifier.
25. The system as in claim 24 wherein said multi-segment, multi-color identifier is capable of identifying and distinguishing a plurality of objects at least equal to approximately:

$$\text{Plurality of objects} = (n \times (n - 1)^{(p-2)} \times (n - 2))/p$$

where n is the number of different colors and p is the number of segments.

26. The system as in claim 25 wherein said multi-segment, multi-color identifier has an inherent orientation.
27. The system as in claim 20 and also comprising a storage unit to store said at least partial image and its associated identification and location codes.
28. The system as in claim 20 further comprising a storage unit to store said identification code and its associated location code.
29. The system as in claim 20 and wherein said imager is a color imager.
30. The system as in claim 20 wherein said at least one imagable identifier comprises a plurality of imagable identifiers arranged in at least predetermined propinquity to each other.
31. The system as in claim 20 wherein said identifier has an inherent orientation.

32. The system as in any of claims 20 - 31 and also comprising at least one monitor displaying said at least partial image in conjunction with its associated said identification and location codes.

33. The system as in any of claims 20 - 32 and wherein said imageable identifier comprises a dynamic indicator.

34. The system as in any of claims 20 - 33 and wherein said imageable identifier provides non-alphanumeric indications of multiple parameters relating to an object onto which the identifier is mounted.

35. The system as in any of claims 20 - 34 and wherein said imageable identifier provides a coded indication of at least two of the following parameters: object location, object identity, object maximum temperature history; object maximum humidity history; object minimum temperature history; object minimum humidity history; object tilt history, object G-force history.

36. The system as in any of claims 20 - 35 and wherein said imager comprises a first plurality of imaging units and said processor comprises a second plurality of processing units, wherein said first plurality is greater than said second plurality.

37. The system as in any of claims 20 - 36 and wherein said imager comprises at least one scanning imager.

38. The system as in any of claims 20 - 37 and wherein said processor comprises means to process images captured at plural locations.

39. A computer-readable medium having computer-executable instructions for performing a methodology for tracking a multiplicity of objects, each of which has an imageable identifier affixed thereto, comprising:

imaging together at a known location a plurality of said objects to provide an at least partial image of said plurality of said objects, said image including at least each of said at least one imageable identifiers;

employing said at least partial image to determine an identification code for each of said plurality of said objects; and

associating each identification code with a known location code.

40. The computer-readable medium as in claim 39 further comprising communicating said at least partial image and its associated identification and location codes to a remote location.

41. The computer-readable medium as in claim 39 further comprising communicating said identification code and its associated location code to a remote location.

42. The computer-readable medium as in claim 39 wherein said at least one imagable identifier comprises a multi-color identifier.

43. The computer-readable medium as in claim 39 wherein said at least one imagable identifier comprises a multi-segment, multi-color identifier.

44. The computer-readable medium as in claim 43 wherein said multi-segment, multi-color identifier is capable of identifying and distinguishing a plurality of objects at least equal to approximately:

$$\text{Plurality of objects} = (n \times (n - 1)^{(p-2)} \times (n - 2))/p$$

where n is the number of different colors and p is the number of segments.

45. The computer-readable medium as in claim 43 wherein said multi-segment, multi-color identifier has an inherent orientation.

46. The computer-readable medium as in claim 43 wherein said steps of imaging, employing and associated are repeated for a plurality of said objects passing a given imaging location.

47. The computer-readable medium as in claim 39 wherein said at least one imagable identifier comprises a plurality of imagable identifiers arranged in at least predetermined propinquity to each other.

48. The computer-readable medium as in claim 39 and also comprising storing said at least partial image and its associated identification and location codes.

49. The computer-readable medium as in claim 39 further comprising storing said identification code and its associated location code.

50. The computer-readable medium as in claim 39 and wherein said imaging is color imaging.

51. The computer-readable medium as in claim 39 wherein said identifier has an inherent orientation.

52. A methodology for tracking objects comprising:

imaging a first plurality of objects together at a first known location to provide a first at least partial image of said plurality of said objects, said first image including at least each of said at least one imagable identifiers;

employing said first at least partial image to determine a first set of identification codes one for each of said first plurality of objects;

associating each of said identification codes of said first set of identification codes with a first known location code;

imaging a second plurality of objects together at a second known location to provide a second at least partial image of said second plurality of said objects, said second image including at least each of said at least one imagable identifiers;

employing said second at least partial image to determine a second set of identification codes one for each of said second plurality of objects; and

associating each of said identification codes of said second set of identification codes with a second known location code.

53. The methodology as in claim 52 wherein said imaging of said first plurality of said objects and said imaging of said second plurality of said objects occur at different times.

54. The methodology as in claim 53 wherein an object in said first plurality of objects is also in said second plurality of objects and said associated identification and location codes with respect to said object are first stored and then updated.

55. The methodology as in claim 52 further comprising communicating at least one of said at least partial image and its associated said identification and location codes to a remote location.

56. The methodology as in claim 52 wherein said at least one imagable identifier comprises a multi-color identifier.

57. The methodology as in claim 52 wherein said at least one imagable identifier comprises a multi-segment, multi-color identifier.

58. The methodology as in claim 57 wherein said multi-segment, multi-color identifier is capable of identifying and distinguishing a plurality of objects at least equal to approximately:

$$\text{Plurality of objects} = (n \times (n - 1)^{(p-2)} \times (n - 2))/p$$

where n is the number of different colors and p is the number of segments.

59. The methodology as in claim 57 wherein said multi-segment, multi-color identifier has an inherent orientation.

60. The methodology as in claim 52 wherein said steps of imaging, employing and associated are repeated for a plurality of said objects passing a given imaging location.

61. The methodology as in claim 52 wherein said at least one imagable identifier comprises a plurality of imagable identifiers arranged in at least predetermined propinquity to each other.

62. The methodology as in claim 52 and wherein said imaging is color imaging.

63. A method comprising:

imaging at least one pallet of objects each object having at least one imagable identifier affixed thereto to provide an image of said at least one pallet; and

identifying identification codes embodied in said at least one imagable identifiers from said image.

64. The method according to claim 63 and wherein said imaging occurs at a known location and also comprising generating a tracking indication comprising said identification code and a known location code.

65. The method as in claim 64 and also comprising storing said tracking indication and said at least partial image.

66. The method as in claim 63 and wherein said imaging is color imaging.

67. The method according to claim 64 further comprising communicating at least one of said tracking indication and said image to a remote location.

68. The method according to claim 63 wherein said at least one imagable identifier comprises a multi-color identifier.
69. The method according to claim 63 wherein said at least one imagable identifier comprises a multi-color, multi-segment identifier.
70. The method according to claim 63 wherein said at least one imagable identifier has an inherent orientation.
71. The method according to claim 63 and also comprising repeating said steps of imaging and identifying for different pluralities of objects passing a given imaging location.
72. A method comprising:
- providing an imaging system with a field of view wide enough to view at least one pallet of objects;
 - imaging said at least one pallet of objects with said imaging system;
 - and
 - using the output of said imaging, identifying identification codes embodied in said at least one imagable identifiers from said image.
73. The method according to claim 72 and wherein said imaging occurs at a known location and also comprising generating a tracking indication comprising said identification code and a known location code.
74. The method as in claim 73 and also comprising storing said tracking indication and said at least partial image.
75. The method as in claim 72 and wherein said imaging is color imaging.
76. The method according to claim 73 further comprising communicating at least one of said tracking indication and said image to a remote location.
77. The method according to claim 72 wherein said at least one imagable identifier comprises a multi-color identifier.
78. The method according to claim 72 wherein said at least one imagable identifier comprises a multi-color, multi-segment identifier.
79. The method according to claim 72 wherein said at least one imagable identifier has an inherent orientation.

80. The method according to claim 72 and also repeating said steps of imaging and identifying for different pluralities of objects passing a given imaging location.

81. A bar code system comprising:

an imaging system with a field of view wide enough to view at least one pallet of objects; and

bar code identification unit operative on an image taken by said imaging system to identify at least a portion of said objects by the bar codes affixed thereon.

82. A system according to claim 81 and wherein said imaging system has a known location and said bar code identification unit comprises a unit to generate a tracking indication comprising said bar code and a known location code.

83. The system according to claim 81 further comprising a communication system to transmit at least one of said tracking indication and said image to a remote location.

84. The system as in claim 82 and also comprising a storage unit to store said tracking indication and said at least partial image.

85. The system as in claim 81 and wherein said imaging system is a color imaging system.

86. A bar code reader comprising:

an imager; and

an optical system associated with said imager with a field of view wide enough to view at least one pallet of objects having bar codes affixed thereto.

87. The reader according to claim 86 wherein said at least one imagable identifier comprises a multi-color identifier.

88. The reader according to claim 86 wherein said at least one imagable identifier comprises a multi-color, multi-segment identifier.

89. The reader according to claim 86 wherein said at least one imagable identifier has an inherent orientation.

90. The reader as in claim 86 and wherein said imager is a color imager.

91. A system for monitoring objects having sensors associated therewith and visually sensible indicators associated with each of said objects, the indicators receiving sensor outputs of said plurality of sensors and providing visually sensible indications of said sensor outputs, the system comprising:

at least one imager to capture images of said visually sensible indicators; and

at least one image processor to receive image outputs of said at least one imager and to extract from said image outputs coded information indicated by said visually sensible indicators.

92. A system for monitoring objects according to claim 91 and also comprising at least one monitor receiving and displaying said coded information from said image processor.

93. A system for monitoring objects according to claim 92 and wherein said at least one monitor is also operative to display said images of said objects in conjunction with said coded information.

94. A system for monitoring objects according to any of claims 91-93 and wherein said visually sensible indicators also indicate object identity information.

95. A system for monitoring objects according to claim 94 and wherein said at least one monitor is remotely located from said objects.

96. A system for monitoring objects according to any of claims 91-95 and wherein said visually sensible indicators are dynamic indicators.

97. A system for monitoring objects according to any of claims 91-96 and wherein said visually sensible indicators provides non-alphanumeric indications of multiple parameters relating to an object onto which the indicator is mounted.

98. A system for monitoring objects according to any of claims 91-97 and wherein said visually sensible indicator provides a coded indication of at least two of the following parameters: object location, object identity, object maximum temperature history; object maximum humidity history; object minimum

temperature history; object minimum humidity history; object tilt history, object G-force history.

99. A system for monitoring objects according to claim 91 and wherein said visually sensible indicator provides a coded indication of at least object identification and object environment history.

100. A system for monitoring objects according to claim 99 and wherein said object environment history is at least one of the following parameters: object maximum temperature history; object maximum humidity history; object minimum temperature history; object minimum humidity history; object tilt history, object G-force history.

101. A system for monitoring objects according to any of claims 99 and 100 and wherein said visually sensible indicator also comprises an indication of object location.

102. A system for monitoring objects according to any of claims 91-98 and wherein said at least one imager comprises a plurality of imagers, which plurality is greater than the number of said at least one image processor.

103. A system for monitoring objects according to any of claims 91-102 and wherein said at least one imager comprises at least one scanning imager.

104. A method comprising:

providing a plurality of sensors being associated with objects being monitored;

providing visually sensible indicators associated with each of said objects;

providing sensor outputs of said plurality of sensors to said visually sensible indicators,;

operating said visually sensible indicators to provide visually sensible indications of said sensor outputs;

employing at least one imager to capture images of said visually sensible indicators; and

employing at least one image processor to receive image outputs of said at least one imager and extract from said image outputs coded information indicated by said visually sensible indicators.

105. A method for monitoring objects according to claim 104 and also comprising remotely receiving and displaying said coded information from said image processor.

106. A method for monitoring objects according to claim 104 or claim 105 and also comprising displaying said images of said objects in conjunction with said coded information.

107. A method for monitoring objects according to any of claims 104 – 106 and also comprising indicating object identity information on said visually sensible indicators.

108. A method for monitoring objects according to claim 107 and also comprising indicating at least one additional parameter relating to said object on said visually sensible indicator.

109. A method for monitoring objects according to any of claims 104 - 108 and also comprising changing the visual display of said visually sensible indicator in real time in accordance with the parameters indicated thereby.

110. A method for monitoring objects according to any of claims 104-109 and also comprising providing non-alphanumeric indications of multiple parameters relating to an object onto which said visually sensible indicator is mounted.

111. A method for monitoring objects according to any of claims 104-110 and also comprising providing a coded indication on said visually sensible indicator of at least two of the following parameters: object location, object identity, object maximum temperature history; object maximum humidity history; object minimum temperature history; object minimum humidity history; object tilt history, object G-force history.

112. A system for monitoring objects according to claim 104 and wherein said visually sensible indicator provides a coded indication of at least object identification and object environment history.

113. A system for monitoring objects according to claim 112 and wherein said object environment history is at least one of the following parameters: object maximum temperature history; object maximum humidity history; object minimum temperature history; object minimum humidity history; object tilt history, object G-force history.

114. A system for monitoring objects according to any of claims 112 and 113 and wherein said visually sensible indicator also comprises an indication of object location.

115. A method for monitoring objects according to any of claims 104-111 and also comprising processing images captured at plural locations.

116. A method for monitoring objects according to any of claims 104-115 and wherein said capturing images employs at least one scanning imager.

117. A visually sensible indicator mountable on an object, the indicator comprising:

coded indication of object identification; and

coded indication of object environment history.

118. An indicator according to claim 117 and wherein said object environment history is at least one of the following parameters: object maximum temperature history; object maximum humidity history; object minimum temperature history; object minimum humidity history; object tilt history, object G-force history.

119. An indicator according to any of claims 117 and 118 and wherein said visually sensible indicator also comprises an indication of object location.

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